

1 Claims

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3 1. A method of identifying an object or structured  
4 parts of an object in an image, the method comprising the  
5 steps of:

6 creating a set of templates, the set containing a  
7 template for each of a number of predetermined object  
8 parts and applying said template to an area of interest  
9 in an image where it is hypothesised that an object part  
10 is present;

11 analysing image pixels in the area of interest to  
12 determine the probability that it contains the object  
13 part;

14 applying other templates from the set of templates to  
15 other areas of interest in the image to determine the  
16 probability that said area of interest belongs to a  
17 corresponding object part and arranging the templates in  
18 a configuration;

19 calculating the likelihood that the configuration  
20 represents an object or structured parts of an object;  
21 and

22 calculating other configurations and comparing said  
23 configurations to determine the configuration that is  
24 most likely to represent an object or structured part of  
25 an object.

26  
27 2. A method as claimed in Claim 1 wherein, the  
28 probability that an area of interest contains an object  
29 part is calculated by calculating a transformation from  
30 the co-ordinates of a pixel in the area of interest to  
31 the template.

32

1 3. A method as claimed in Claim 1 or Claim 2 wherein,  
2 analysing the area of interest further comprises  
3 identifying the dissimilarity between foreground and  
4 background of a transformed probabilistic region.  
5

6 4. A method as claimed in any preceding claim wherein,  
7 analysing the area of interest further comprises  
8 calculating a likelihood ratio based on a determination  
9 of the dissimilarity between foreground and background  
10 features of a transformed template.  
11

12 5. A method as claimed in any preceding claim wherein,  
13 the templates are applied by aligning their centres,  
14 orientations in 2D or 3D and scales to the area of  
15 interest on the image.  
16

17 6. A method as claimed in any preceding Claim wherein  
18 the template is a probabilistic region mask in which  
19 values indicate a probability of finding a pixel  
20 corresponding to an object part.  
21

22 7. A method as claimed in any preceding claim wherein,  
23 the probabilistic region mask is estimated by  
24 segmentation of training images.  
25

26 8. A method as claimed in any preceding claim wherein,  
27 the image is an unconstrained scene.  
28

29 9. A method as claimed in any preceding claim wherein,  
30 the step of calculating the likelihood that the  
31 configuration represents an object or a structured part  
32 of an object comprises calculating a likelihood ratio for

1 each object part and calculating the product of said  
2 likelihood ratios.

3  
4 10. A method as claimed in any preceding claim wherein,  
5 the step of calculating the likelihood that the  
6 configuration represents an object comprises determining  
7 the spatial relationship of object part templates.

8  
9 11. A method as claimed in Claim 10 wherein the step of  
10 determining the spatial relationship of the object part  
11 templates comprises analysing the configuration to  
12 identify common boundaries between pairs of object part  
13 templates.

14  
15 12. A method as claimed in Claim 11 wherein the step of  
16 determining the spatial relationship of the object part  
17 templates requires identification of object parts having  
18 similar characteristics and defining these as a sub-set  
19 of the object part templates.

20  
21 13. A method as claimed in any preceding claim, wherein  
22 the step of calculating the likelihood that the  
23 configuration represents an object or structured part of  
24 an object comprises calculating a link value for object  
25 parts which are physically connected.

26  
27 14. A method as claimed in any preceding claim wherein  
28 the step of comparing said configurations comprises  
29 iteratively combining the object parts and predicting  
30 larger configurations of body parts.

31  
32 15. A method as claimed in any preceding claim wherein  
33 the object is a human or animal body.

1  
2 16. A system for identifying an object or structured  
3 parts of an object in an image, the system comprising:  
4 a set of templates, the set containing a template for  
5 each of a number of predetermined object parts  
6 applicable to an area of interest in an image where it is  
7 hypothesised that an object part is present;  
8 analysis means for determining the probability that the  
9 area of interest contains the object part;  
10 configuring means capable of arranging the applied  
11 templates in a configuration;  
12 calculating means to calculate the likelihood that the  
13 configuration represents an object or structured parts of  
14 an object for a plurality of configurations; and  
15 comparison means to compare configurations so as to  
16 determine the configuration that is most likely to  
17 represent an object or structured part of an object.  
18

19 17. A system as claimed in Claim 16 wherein, the system  
20 further comprises imaging means capable of providing an  
21 image for analysis.  
22

23 18. A system as claimed in claim 17 wherein the imaging  
24 means is a stills camera or a video camera.  
25

26 19. A system as claimed in Claims 16 to 18 wherein, the  
27 analysis means is provided with means for identifying the  
28 dissimilarity between foreground and background of a  
29 transformed probabilistic region.  
30

31 20. A system as claimed in Claims 16 to 19 wherein, the  
32 analysis means calculates the probability that an area of  
33 interest contains an object part by calculating a

1 transformation from the co-ordinates of a pixel in the  
2 area of interest to the template.

3  
4 21. A method as claimed in any of Claims 16 to 20  
5 wherein, the analysis means calculates a likelihood ratio  
6 based on a determination of the dissimilarity between  
7 foreground and background features of a transformed  
8 template.

9  
10 22. A system as claimed in Claims 16 to 21 wherein, the  
11 templates are applied by aligning their centres,  
12 orientations (in 2D or 3D) and scales to the area of  
13 interest on the image.

14  
15 23. A system as claimed in any of Claims 16 to 22  
16 wherein the template is a probabilistic region mask in  
17 which values indicate a probability of finding a pixel  
18 corresponding to the body part.

19  
20 24. A system as claimed in any of Claims 16 to 22  
21 wherein, the probabilistic region mask is estimated by  
22 segmentation of training images.

23  
24 25. A system as claimed in Claims 16 to 24 wherein, the  
25 image is an unconstrained scene.

26  
27 26. A system as claimed in Claims 16 to 25 wherein, the  
28 calculating means calculates a likelihood ratio for each  
29 object part and calculating the product of said  
30 likelihood ratios.

31  
32 27. A system as claimed in Claim 26 wherein, the  
33 likelihood that the configuration represents an object

1 comprises determining the spatial relationship of object  
2 part templates.

3  
4 28. A system as claimed in Claim 27 wherein the spatial  
5 relationship of the object part templates is calculated  
6 by analysing the configuration to identify common  
7 boundaries between pairs of object part templates.

8  
9 29. A system as claimed in Claim 28 wherein the spatial  
10 relationship of the object part templates is determined  
11 by identifying object parts having similar  
12 characteristics and defining these as a sub-set of the  
13 object part templates.

14  
15 30. A system as claimed in any preceding claim, wherein  
16 the calculating means is capable of calculating a link  
17 value for object parts which are physically connected.

18  
19 32. A system as claimed in any of claims 16 to 31  
20 wherein the calculating means is capable of iteratively  
21 combining the object parts in order to predict larger  
22 configurations of body parts.

23  
24 33. A method as claimed in Claims 16 to 32 wherein the  
25 object is a human or animal body.

26  
27 34. A computer program comprising program instructions  
28 for causing a computer to perform the method of any of  
29 Claims 1 to 15.

30  
31 35. A computer program as claimed in claim 34 wherein  
32 the computer program is embodied on a computer readable  
33 medium.

1 36. A carrier having thereon a computer program  
2 comprising computer implementable instructions for  
3 causing a computer to perform the method of any of claims  
4 1 to 15.

5  
6 37. A markerless motion capture system comprising  
7 imaging means and a system for identifying an object or  
8 structured parts of an object in an image as claimed in  
9 any of Claims 16 to 33.

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